Research Note

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HIGH BROWSE YIELD IN A PLANTED STAND OF BITTERBRUSH

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ABSTRACT

A 10-year-old stand of antelope bitterbrush [Purshia tridentata *(Pursh) DC.] established by direct seeding on a deer winter range in southwestern Idaho yielded an exceptionally high 696 kg/ha (621 lb/acre) of ovendry browse in 1967. We suggest that this high year-specific yield, twice that previously reported for bitterbrush, was the result of (1) a favorable circumstance of weather and exceptionally good soil moisture, and (2) soil and site characteristics conducive to bitterbrush growth. The growing season was marked by a cool spring and June rainfall that was twice the long-term average. The soil of the planting site, developed from granitic colluvium, is relatively young, moderately deep, coarse textured, well drained, and slightly acidic.*

KEYWORDS: bitterbrush planting, high yield, weather effects.

Shrubs are increasingly used to restore disturbed rangelands in the Intermountain Region. They offer certain advantages because of their productivity, palatability, nutritional qualities, and value as wildlife habitat and cover for the soil (McKell and others 1972). Yet, relatively little is known about the growth performance of planted shrubs in the Intermountain Region, an area characterized by low rainfall that is poorly distributed spatially, seasonally, and yearly.

During the growing season of 1967 we observed exceptional growth of antelope bitterbrush [*Purshia tridentata* (Pursh) DC.] in southwestern Idaho. Current shoot lengths over 50 cm (20 inches) were common and some exceeded 80 cm (31 inches). To document this growth, we sampled the current yield from a 10-year-old planting of bitterbrush on a deer winter range 32 km (20 miles) east of Boise. The 1.43-ha (3.53-acre) stand was established from seed by the Idaho Fish and Game Department in the autumn of 1957.

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The planting is located on a gently rolling terrace of granitic colluvium that is underlain by basalt. Soils are characteristically coarse textured and either gravelly or stony. Slope gradients within the planting vary from 6 percent to 15 percent and mostly slope to the southwest. The elevation is 976 m (3,200 feet).

Average annual precipitation is about 50 cm (20 inches), most of which falls as snow in winter. Summer rains generally occur as infrequent, scattered, high-intensity thundershowers.

Common grasses on the site include cheatgrass (*Bromus tectorum* L.), squirreltail (*Sitanion hystrix* Nutt.), bulbous bluegrass (*Poa bulbosa* L.), and bluebunch wheatgrass [*Agropyron spicatum* (Pursh) Scribn. and Smith]. Among the many forbs, storksbill [*Erodium cicutarium* (L.) L'Her.], goatsbeard (*Tragopogon dubius* Scop.), Douglas knotweed (*Polygonum douglasii* Greene), ground smoke (*Gayophytum diffusum* Torr. and Gray), and prickly lettuce (*Lactuca serriola* L.) are the most common. Big sagebrush (*Artemisia tridentata* Nutt.) and rubber rabbitbrush [*Chrysothamnus nauseosus* (Pall.) Britton] occur as solitary plants scattered throughout the bitterbrush stand.

We estimated bitterbrush yield in November 1967 by (1) counting all live bitterbrush shrubs in the measured 1.43-ha (3.53-acre) stand; (2) clipping, ovendrying, and weighing the current annual growth from 34 randomly chosen sample shrubs; and (3) applying the mean ovendry yield to the total number of live shrubs. We also measured the total height and crown diameter of each sample shrub.

FINDINGS

Bitterbrush density in the planted stand was 1,877 live shrubs per hectare (760 per acre). Heights of individual shrubs before clipping averaged (±SD) 1.07 ± 0.15 m (3.51 ± 0.49 feet); crown diameters averaged 1.26 ± 0.23 m (4.13 ± 0.75 feet). Mean ovendry yield per bitterbrush plant was 371 ± 133 g (0.82 ± 0.29 lb). Expressed on a unit-area base, the ovendry yield of bitterbrush was 696 ± 249 kg/ha (621 ± 222 lb/acre). We are unaware of any published data on single-year bitterbrush yields that exceed this value. Blaisdell (1953) reported a bitterbrush yield of 348 kg/ha (311 lb/acre) in southeastern Idaho. Hormay (1943) suggested that some bitterbrush stands in California might yield as much as 1 010 kg/ha (900 lb/acre).

We described soil profiles at three locations in the planted stand. Soil characteristics are summarized as a composite profile in table 1. The soil is relatively young, coarse textured, well-drained, moderately deep, and slightly acidic. A large gravel fraction was found throughout the soil profile. Clay fractions were consistently low. Hormay (1943) and Nord (1965) found similar soil characteristics on the most productive bitterbrush sites in California.

Bitterbrush growth is known to be sensitive to both seasonal and annual fluctuations in precipitation (Garrison 1953, Shepherd 1971). Therefore, we examined local weather records for a possible explanation of the unusually high yield observed in 1967. Monthly means of precipitation and temperature immediately preceding and during the growing season are compared with long-term records in table 2. Weather data were summarized from U.S. Weather Service records at Arrowrock Dam, located about 10 km (6 miles) from the bitterbrush planting site and at about the same elevation.

Table 1.--*Physical characteristics of a composite soil profile, South Fork Boise River, Idaho*

Horizon	Depth	pH	Moisture retained at two tensions		Particle size distribution			
			1/3 bar	15 bars	Gravel	Sand	Silt	Clay
	cm (Inches)		*Percent*					
A_{11}	0-5 (0-2)	6.3	12.6	5.6	44.5	76.7	18.2	5.1
A_{12}	5-20 (2-8)	5.8	10.8	4.6	44.2	75.7	18.4	5.9
AC	20-40 (8-16)	5.6	10.7	4.7	45.7	75.5	17.1	7.4
C_1	40-60 (16-24)	5.6	9.5	4.3	45.3	76.8	16.3	6.9
C_2	60-90 (24-36)	5.7	10.6	4.1	46.8	77.4	15.4	7.2
C_3	90+ (36+)	5.7	9.2	4.1	48.1	78.4	14.6	7.0

Table 2.--*Comparison of 1966-67 weather data with long-term records, Arrowrock Dam, Idaho*

Month	Precipitation		Temperature	
	Total	Departure from normal	Mean	Departure from normal
	cm		°C	
Oct.	1.2	-2.0	8.9	-1.5
Nov.	6.8	+0.9	5.0	+2.4
Dec.	6.2	-0.9	-0.7	+0.8
Jan.	9.9	+2.8	0.2	+4.4
Feb.	2.6	-4.0	2.0	+3.3
Mar.	2.5	-2.9	4.2	+1.0
Apr.	3.9	+0.1	5.4	-3.7
May	1.6	-2.0	12.7	-1.0
June	6.9	+4.1	17.2	-0.4
July	0.3	-0.4	24.4	+1.0
Aug.	0.0	-0.4	24.4	+2.1
Sept.	1.4	+0.2	19.1	+2.0
Year	43.3 (17.1 inches)	-4.5 (-1.8 inches)	10.2 (50.4°F)	+0.9 (+1.6°F)

A relatively warm winter was followed by a cool spring marked by below-average precipitation except for the month of June, during which rainfall was more than double the long-term average. Most of the June rainfall was from four thunderstorms that were distributed throughout the month (June 1, 6, 10, and 21). More than 1 cm (0.394 inches) of rain fell during each of the four storms. Measurable rainfall occurred on each of 12 days during the month. Total precipitation during June was the second highest on record.

We suggest that the exceptionally high yield of bitterbrush observed in 1967 was the result of (1) a cool spring and abnormally high rainfall in June, resulting in unusually high soil moisture, and (2) soil and site characteristics conducive to bitterbrush growth. Most of the current shoot growth of bitterbrush occurs during June in southwestern Idaho.

PUBLICATIONS CITED

Blaisdell, James P.
1953. Ecological effects of planned burning of sagebrush-grass range on the Upper Snake River Plains. U.S. Dep. Agric. Tech. Bull. 1075, 39 p. Washington, D.C.

Garrison, George A.
1953. Annual fluctuation in production of some eastern Oregon and Washington shrubs. J. Range Manage. 6(2):117-121.

Hormay, August L.
1943. Bitterbrush in California. U.S. Dep. Agric., For. Serv., Calif. For. and Range Exp. Stn. Res. Note 34, 13 p.

McKell, Cyrus M., James P. Blaisdell, and Joe R. Goodin (Technical Editors).
1972. Wildland shrubs -- their biology and utilization. An International Symposium, Utah State Univ., Logan, July 1971. USDA For. Serv. Gen. Tech. Rep. INT-1, 494 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.

Nord, Eamor C.
1965. Autecology of bitterbrush in California. Ecol. Monogr. 35(3):307-334.

Shepherd, Harold R.
1971. Effects of clipping on key browse species in southwestern Colorado. Colo. Div. Game, Fish and Parks Tech. Publ. 28, 104 p.

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